**PPPS 2019** 



Contribution ID: 635

Type: Oral

## Study on Insulation Characteristics Evolution of Oil-impregnated Paperboard under Mechanical Stress

Friday 28 June 2019 17:00 (15 minutes)

## I.INTRODUCTION

During the long-term running of transformer, its oil-paper insulation system withstands various stresses of temperature, mechanical stresses and electric fields, which will continue to age. There is much research on electrical aging and heat aging, but few research on aging under mechanical stress.

## **II.EXPERIMENTAL PLATFORM AND PROCESS**

In order to simulate the pressing force of the transformer during steady-state operation and the impact force during short-circuit operation, two kinds of force are loaded on the paperboard: the stress amplitudes are 30MPa, 50MPa, 70MPa, and the loading time is 60s; the amplitude of the force is 50MPa, with frequencies of 5Hz, 10Hz, 15Hz, 20Hz, all lasting 1200 cycles. After that, the loaded paperboard was subjected to strain measurement, confocal microscopy and partial discharge test.

## **III.RESULTS AND DISCUSSION**

According to PRPD, the process of discharge is divided into three stages: initial stage, developing stage, severe stage. With the amplitude of stress increasing or the frequency of stress decreasing, PRPD pattern changes from "turtle" to "rabbit ear". An experiment with compression superimposed multi-layer paperboard shows that the spectral shape transformation is caused by the difference in fiber structure strain at different positions of the pressboard.

The higher the mechanical stress amplitude or the lower the frequency is, as a result, the strain of the insulating paperboard becomes greater, the damage of the fiber structure gets more serious, partial discharge inception voltage and the breakdown time value of the paperboard become lower, and the discharge repetition rate and the maximum discharge amount get higher. The "solid dielectric air gap model" and the "effective time model of stress action" are proposed to explain the above experimental results, respectively.

Author: Mr XIAO, Yao (School of Electrical Engineering, Xi'an Jiaotong University)

**Co-authors:** Mr CUI, Yan-Jie (School of Electrical Engineering, Xi'an Jiaotong University); Mr LI, Xi-Ning (School of Electrical Engineering, Xi'an Jiaotong University); Prof. JI, Sheng-Chang (School of Electrical Engineering, Xi'an Jiaotong University)

**Presenter:** Mr XIAO, Yao (School of Electrical Engineering, Xi'an Jiaotong University)

Session Classification: 5.5 Insulation and Dielectric Breakdown III

Track Classification: 5.5 Insulation and Dielectric Breakdown